July 2010

Policy brief

Leaving Room in the CBD's ABS Protocol for the future development of specialized access and benefit-sharing arrangements

The example of agricultural microbial genetic resources

Based on a side event held during the 9th session of the Ad Hoc Open-ended Working Group on Access and Benefit-sharing (ABS WG9), held in Cali, Colombia, 22-28 March, 2010.
See Box 1 for panellists and presentations. Further details of the side event are available on the CBD website.[1]

Introduction

The goal of this policy brief is to explain why the Access and Benefit-Sharing (ABS) Protocol[2], currently being negotiated under the framework of the Convention for Biological Diversity, should make space for the future development of specialized international access and benefit-sharing rules and arrangements. The brief presents a single concrete example to illustrate this point. The example concerns agricultural microbial genetic resources (AMiGR), focusing on those aspects of their biophysical nature and the ways they are used that justify developing specialized access and benefit-sharing agreements.

AMiGR are microbes (and their genetic parts and components) that influence the production of plants or animals in agriculture systems, such as those that:

- promote plant and ruminant growth through symbiotic endophytes
- cause diseases
- act as biological control agents
- fix and cycle nutrients in soil

The most abundant living organisms on earth are microbes

The most plentiful but least characterized or understood organisms in the world are microbes. The numbers are daunting: of the 5–30 million microbial species thought to exist, only two million have been taxonomically described. In every gram of soil, over a billion bacteria cells can be found but fewer than 5% of them have been described. Similarly, only 5% of the 1.5 million species of fungi estimated to exist have been taxonomically described. The World Data Centre for Microbes (WDCM[3]) has registered almost 2 million culture holdings in 525 collections worldwide, including Africa, Asia, Europe, America and Oceania. Brazil has 29 collections that include about 30 000 specimens including fungi and bacteria from invertebrates, entomopathogenic and phytopathogenic microbes and diazotrophic bacteria, among others. The international, and in many cases ubiquitous, distribution of microbes in the air, water, soil, stomachs of animals, poses particular challenges for the application of the CBD's concepts of country of origin (including *in situ* conditions).

Diversity of AMiGR can be used to manage impacts of climate change

The vast and diverse range of microbes and corresponding range of functions is of direct relevance to food security and income generation. This is particularly important in sustainable farming systems in developing countries, where the bulk of the population is directly dependent on agricultural performance. Due to their potential for causing disease in plants, microbes can negatively affect crop productivity, food safety and ability to meet international trade standards. Conversely, microbes can affect plant production positively through increased acquisition of nutrients via symbiotic associations, nutrient cycling processes and biological control of pests.

Crops of different species and varieties are being introduced into diverse environments across the world and their success in each location is dependent on ecological interactions with microbes. These ecological interactions will be significantly influenced as farming systems become intensified and marginal land is cultivated to meet the demand to double agricultural production by 2050. Further, in addition to changes in land use management, globalization of

System-wide Genetic Resources Programme (SGRP)
of the Consultative Group on International Agricultural Research (CGIAR)
c/o Bioversity International
Via dei Tre Denari, 472/a
00057 Maccarese
Rome, Italy
Tel: (39) 0661181
Fax: (39) 0661979661
Email: SGRP-Secretariat@cgiar.org
www.sgrp.cgiar.org

The SGRP is a partnership programme of the 15 Centres of the CGIAR.

trade and increased human movement will provide selection pressures on ecological interactions between microbes and crops. One of the greatest influences will be as a consequence of imminent threats posed by climate change. In general, the world is warming and carbon dioxide is increasing, while flooding and droughts will become more frequent but increasingly unpredictable. For plant diseases, infection by bacteria and fungi will be favoured by increased humidity and temperature whereas infection by viruses will be increased by elevated temperature. The geographical distribution of microbes will change as some areas become more conducive while others less favourable. Further, higher temperatures will increase the number of crop cycles per year and thus the rate of disease cycles. This will lead to more rapid evolutionary change and increase the probability that genetic crop resistance and resistance to chemical pesticides will be overcome by disease-causing microbes.

In order to authoritatively assess risk and deploy mitigation strategies, AMiGR need to be characterized and managed. Taking the example of crop diseases, rapid and reliable diagnosis is required for organisms that cause disease as a critical precursor to the deployment of appropriate control measures. This requires an understanding of the variability within and among each disease-causing microbial population so as to facilitate precise diagnoses. Similarly for beneficial organisms, key species and variants that confer healthy soils and vigorous crop plants need to be identified and characterized for the potential of these organisms to be realized. Early and reliable diagnostics of disease will permit a shift from the current situation in developing countries of fighting fully blown disease epidemics to being able to provide pre-emptive control through deployment of control interventions. Conversely, recognition of key beneficials will permit cultivation of specific crops at targeted locations that act in synergy with selected microbes to promote sustainable agricultural production. Climate change will increase countries' interdependence on AMiGR, i.e. countries will be even more reliant on AMiGR found outside their own borders for the purposes of research, training or direct use. Awareness of and access to AMiGR can be best facilitated through collections as it is not practical to expect materials, equipment and, in particular, human expertise and skills necessary for characterization and preservation of AMiGR to be available in every country.

The benefit of internationally pooled genetic resources of AMiGR

A deadly banana disease called *Fusarium* wilt previously wiped out global production of dessert banana. Although the centre of origin of this disease was Asia Pacific, it spread across the globe in the mid 1900s causing losses of over 50 000 Ha and USD 400 million. In response to the emergence of this disease, resistant cultivars belonging to Cavendish clones were cultivated in place of market-favoured, susceptible varieties such as Gros Michel. However, a new variant of *Fusarium* wilt has recently emerged in Asia and is devastating plantations of Cavendish and trade revenues, particularly in parts of China and Indonesia. This variant is called Tropical Race 4 (TR4) and poses an enormous threat to global dessert banana production (currently worth USD 5 billion) and juicing bananas, and thus to food security through its impact on staple foods such as plantain and cooking banana in Asia, Africa, Latin America and the Caribbean. At an international meeting in El Salvador, July 2009, stakeholders in the Americas recognized the risk of TR4 and discussed strategies to pre-empt the introduction and spread of this disease in the region. Recommended priorities included the need to improve epidemiological understanding of this disease and to identify potential tolerant or resistant traits in different types of banana. Further, it was recognized that major constraints towards the development of a mitigation strategy were the absence of trained scientists as well as access to isolates of TR4 to characterize the variability of the fungus that causes this disease. Without knowing how variable the fungus is, it is impossible to develop appropriate diagnostic methods or to identify control interventions to curtail disease introduction, establishment or spread. Therefore, the most urgent priority was identified as the creation of a global collection of *Fusarium* wilt-causing isolates of the fungus of different strains, including the newly emerged TR4. This facility would provide a platform to increase awareness of the presence of isolates, mechanisms to share the isolates, benefit-sharing of isolates to recognize country of origin, and characterization of isolates. Efforts are currently underway to establish this collection in Belgium and to develop appropriate frameworks for access and benefit-sharing.[4]

Another example of the benefits derived from sharing AMiGR is the Gates-supported Biological Nitrogen Fixation project through which microorganisms from different countries will be provided to boost nitrogen fixation in Africa. Improved crop and livestock productivity, human nutrition and farm income, as well as enhanced soil health are expected to ensue.

Informal exchanges and unfortunate trends in availability and use

It has been speculated that up to 60% of microbial isolate transfer is 'informal', that is, without written contracts. These exchanges are often between scientists and organizations known to each other, and not through open, public, transparent exchange mechanisms. This leads to underutilization of the resources concerned and missed opportunities for sharing increased scientific knowledge, economic gains, and benefits with provider countries. On the other hand, the holders of some of the biggest, most important culture collections are imposing unduly restrictive conditions on access to their collections, such as high fees for supplying isolates, consequently prohibiting recipients from passing on strains to others, and imposing 'pass through' conditions such that they will be co-owners of any new products developed through use of the material received. This approach significantly raises costs of research, having a disproportionate impact on research organizations in developing countries. There is a growing body of evidence that countries are increasingly reluctant to make AMiGR available for research/direct deployment as a result of uncertainty about appropriate benefit-sharing arrangements, traceability etc. This situation continues, despite the fact that the vast majority of materials in culture collections does not, and probably will not, give rise to commercially exploitable products. Ultimately, public benefit that would otherwise be derived from the use of these resources in non-commercial research is being undermined by legal uncertainties and discomfort about possible missed opportunities for benefit-sharing.

A possible specialized ABS arrangement/solution?

In light of the above, it is certainly worthwhile exploring the development of specialized international access and benefit-sharing rules and arrangements that would both: a) support important research efforts like those described above; and b) 'formalize' the existing informal systems of exchange in ways that would address the benefit-sharing concerns of would-be suppliers of AMiGR. One possible approach would be to develop a virtual common pool of AMiGR which would be available for use in agricultural research and production and subject to pre-agreed terms and conditions. It would be 'virtual' in the sense that the strains would not be pooled in a single location, but would help create and be part of a network of holders of microbial collections around the world that agree to participate in the creation of the pool. The pre-agreed terms could address conditions of access, sharing of information based on use of the isolates, benefit-sharing, subsequent transfers to other users, identity and quality maintenance , monitoring and so on. These terms could be reflected in a material transfer agreement that would always be used when distributing the common pooled AMiGR. As far as benefit-sharing is concerned, the material transfer agreement could include the condition that materials are available for all prescribed uses, including the commercialization of new products. However, in the event that a new product is commercialized, a fixed percentage of revenues would be shared with some combination of the provider organization, the country from which the strain was originally collected (if known), and/or an international benefit-sharing fund. A variant of this kind of liability rule is included in the Standard Material Transfer Agreement (SMTA) used in the multilateral system of access and benefit-sharing created by the International Treaty on Plant Genetic Resources for Food and Agriculture.[5] The point of this brief is not to actually suggest what specific uses or benefit-sharing terms would be most appropriate. Instead the point is to demonstrate that the Protocol needs to leave space for future international intergovernmental consideration of precisely these issues.

The advantage of such a system is that it would provide incentives to bring the bulk of informally exchanged materials into line with existing ABS and sanitary laws, facilitating traceability and quality control. It would also support including information about those same materials in internationally coordinated digital information systems. This virtual pool would probably not include high value, or potentially high value, AMiGR since would-be providers of those resources would likely prefer to exploit other arrangements to maximize their commercial return from their exploitation.

The importance of creating space in the Protocol for the future development of specialized ABS arrangements

The kind of system described above would require endorsement and support from an intergovernmental body to be truly effective. For example, it would be much easier for nationally-based culture collections to participate if an international, intergovernmental body – including their own governments – considered and endorsed the basic rules for the operation of the virtual AMiGR pool. As anticipated above, the intergovernmental body could consider/endorse such specialized aspects of the system as the benefit-sharing terms and the material transfer agreement(s) that could be used when transferring materials from the pool. It would also be very useful if an intergovernmental body could monitor progress in the implementation of the system, and made high-level policy recommendations for its improvement.

The development of specialized ABS arrangements such as those considered above could potentially 'formalize' hundreds of thousands of exchanges of microbial isolates a year; subject those exchanges to benefit-sharing obligations; improve traceability and boost the quality of related information systems. This is surely in everyone's interest, especially when it builds upon and provides support for the use of those resources in agricultural research and development. Unfortunately, there is not time enough to consider all of the necessary issues before the Protocol is adopted in Nagoya in October 2010. The only solution, therefore, is to ensure that the Protocol explicitly creates room (or a mandate even) to consider such specialized arrangements in the future. It seems almost certain that the future Governing Body of the Protocol on ABS will want to have the flexibility to consider such arrangements itself, or to catalyze processes whereby other intergovernmental bodies consider such arrangements in a harmonized, jointly coordinated manner. In their efforts to create an effective, enforceable Protocol, negotiators should not pre-empt possible future endeavours to develop specialized arrangements that could actually be more effective and enforceable than the generic, current Protocol text appears to anticipate creating.

References/further reading

Beed, F. 2009. The Impact of Climate Change on Interdependence for Microbial Genetic Resources for Agriculture. In Fujisaka, S., Halewood, M., Williams, D. (Eds.) The impact of Climate Change on Countries' Interdependence on Genetic Resources for Food and Agriculture: Background Study Paper No.48 prepared for the 12 Session of the Commission on Genetic Resources for Food and Agriculture, Rome November 2009, available at ftp://ftp.fao.org/docrep/fao/meeting/017/ak532e.pdf

Dedeurwaerdere, T., Iglesias, M.J., Weland, S.., Halewood, M. 2009. The Use and Exchange of Microbial Genetic Resources for Food and Agriculture: Background Study Paper No.46 prepared for the 12th Session of the Commission on Genetic Resources for Food and Agriculture, Rome November 2009, available at ftp://ftp.fao.org/docrep/fao/meeting/017/ak566e.pdf

Halewood, M. 2010. Governing the management and use of pooled microbial genetic resources: Lessons from the global crop commons. International Journal of the Commons Vol. 4, no 1 February 2010, pp. 404-436. ISSN: 1875-0281. Igitur, Netherlands. Available at http://www.thecommonsjournal.org/index.php/ijc/article/view/152

Howieson, J.G. 2007. Technical issues relating to Agricultural Microbial Genetic Resources (AMiGRs), including their characteristics, utilization, preservation and distribution. A draft information paper submitted to the Eleventh Regular Session of the Commission on Genetic Resources for Food and Agriculture, 11-15 June, 2007. Available at ftp://ftp.fao.org/ag/cgrfa/cgrfa11/r11c3e.pdf

Marina Barba M., Van den Bergh I., Belisarioa A. and Beed F. 2010. The need for culture collections to support plant pathogen diagnostic networks. Research in Microbiology (ISI). In press. Available online 10 May 2010. doi:10.1016/j.resmic.2010.04.008

Rai., A., Reichman, J.H., Uhlir, P., Crossman, C. 2008. *Pathways Across the Valley of Dearth: Novel Intellectual Property Strategies for Accelerating Drug Discovery.* Yale Journal of Health Policy, Law and Ethics. Volume 8, Issue 1.

Reichman, J.H. 2000. *Of Green Tulips and Legal Kudzu: Repackaging Rights in Subpatentable Inventions.* 53 Vand. L.Rev. 1743

Reichman, J.H., Dedeurwaerdere, T., Uhlir, P. (forthcoming) *Designing the Microbial Research Commons: Strategies for Accessing, Managing, and Using Essential Public Knowledge Assets.*

Endnotes

1 CBD website: http://www.cbd.int/wgabs9/events/se-abs9.shtml?tab=

2 The Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization to the Convention on Biological Diversity, available at: UNEP/CBD/WG-ABS/9/3, http://www.cbd.int/doc/meetings/abs/abswg-09-2nd/official/abswg-09-2nd-03-en.doc

3 WDCM website: http://wdcm.nig.ac.jp

4 Marina Barba M., Van den Bergh I., Belisarioa A. and Beed F. 2010. The need for culture collections to support plant pathogen diagnostic networks. Research in Microbiology (ISI). In press. Available online 10 May 2010. doi:10.1016/j.resmic.2010.04.008

5 International Treaty on Plant Genetic Resources for Food and Agriculture. The SMTA is available on the Treaty website at: http://www.planttreaty.org/smta_en.htm.

Box 1. Panellists and presentation titles at side event

Leaving room for future development of ABS norms under the international regime – the example of agricultural microbial genetic resources

Side event on 24 March 2010, at ABS WG 9, Cali, Colombia

- Countries' interdependence on agricultural microbial genetic resources (AMiGR).
  Maria José Sampaio, Policy Advisor, Brazilian Agriculture Research Corporation (Embrapa) Ministry of Agriculture
- Increased interdependence on AMiGR as a result of climate change. Fen Beed, Plant Pathologist, International Institute of Tropical Agriculture (IITA), Republic of Benin, West Africa
- The importance of internationally pooled microbial genetic resources for agricultural research: the case study of *Fusarium oxysporum*.
  Luis Pocasangre, Professor-Researcher, CATIE, and Scientist and Regional Coordinator for Latin America and the Caribbean, Bioversity International, Costa Rica
- The basic components of an international microbial commons.
  Jerome H. Reichman, Bunyan S. Womble Professor of Law, Duke University School of Law, USA
- Opportunities for the development of ABS norms under the International Regime.
  Michael Halewood, Head, Policy Unit, Bioversity International.

This brief was developed by Bioversity International for SGRP.

Correct citation: SGRP. 2010. Leaving Room in the CBD's ABS Protocol for the future development of specialized access and benefit-sharing arrangements – the example of agricultural microbial genetic resources. SGRP, Rome, Italy. 4 pp.